

AMENDMENTS
To
THE WATER QUALITY CONTROL PLAN FOR THE
SACRAMENTO RIVER AND SAN JOAQUIN RIVER
BASINS

FOR

THE CONTROL OF ORCHARD PESTICIDE RUNOFF AND
DIAZINON RUNOFF INTO THE SACRAMENTO AND
FEATHER RIVERS

FINAL STAFF REPORT

APPENDIX G

TOXICITY STUDIES USED IN NOVARTIS RISK
ANALYSIS

Overview

The table below includes the toxicity studies that were reportedly used by Novartis in their ecological risk assessment conducted for the Sacramento-San Joaquin Basins (Novartis, 1997). The studies are from the U.S. Environmental Protection Agency's (USEPA) AQUIRE database, as reported in Table 10 of the Novartis (1997) report.

Since the Novartis report was published, the USEPA has incorporated the AQUIRE database into the ECOTOX database, which can be accessed at:

<http://www.epa.gov/ecotox/>. The table below provides the studies reportedly used by Novartis together with the data attributes reported in the USEPA's ECOTOX database.

Those studies that reported toxicity endpoints based on formulation concentration are shaded. As described by USEPA (2003), a study that is coded with an “F” for formulation represents the concentration of the pesticide product used in the experiment. The pesticide product formulation used in such studies are “[g]enerally reserved for commercial preparation prior to actual use and does not include the final dilution(e.g.; Baythroid, 2,4-D)”. The formulation concentration does not represent the concentration of the active ingredient in the pesticide product, but the concentration of the product itself. The pesticide product may include a significant amount of “inert” ingredients.

As described by USEPA (2003), a study that is coded with an “A” for active ingredient means that the “[a]uthor refers to the concentration as active ingredient, active principle or various grades of reagents.”

References

Novartis Crop Protection, Inc. 1997. Ecological Risk Assessment of Diazinon in the Sacramento-San Joaquin Basins. Technical Report 11/97. Environmental and Public Affairs Department. Greensboro, NC

U.S. Environmental Protection Agency. 2003. EPA: ECOTOX Code List. Accessed on 8/26/2003 & 8/28/2003 at <http://www.epa.gov/ecotox/help/codelist.htm>.

Scientific name	Common name	Endpoint ^a	Effect/Effect Measured ^b	Duration	Concentration ($\mu\text{g/L}$) ^c	Reference
<i>Gammarus fasciatus</i>	Scud	LC50	MOR	96 h	A 0.20, 0.15 - 0.28	Johnson and Finley, 1980
<i>Ceriodaphnia dubia</i>	Water flea	LC50	MOR	48 h	F 0.50, 0.43 - 0.61	Ankley et al, 1991
<i>Daphnia pulex</i>	Water flea	EC50	ITX/IMBL	48 h	F 0.90, 0.67 - 1.2	Sanders and Cope, 1966
		EC50	ITX/IMBL		A 0.8, 0.6 - 1.1	Johnson and Finley, 1980
		LC50	MOR		F 0.650, 0.53 - 0.80	Ankley et al, 1991
<i>Daphnia magna</i>	Water flea	EC50	ITX/IMBL	48 h	A 0.7, 0.6 - 0.9	Dortland, 1980
		EC50	ITX/IMBL		F 1.22	Dennis et al, 1979
		EC50	ITX/IMBL		F 1.25	Dennis et al, 1979
		EC50	ITX/IMBL		A 1.5, 1.3 - 1.6	Dortland, 1980
		EC50	ITX/IMBL		A 0.8, 0.7 - 1.0	Dortland, 1980
		LC50	MOR		F 0.56 - 1.0	Maas, 1982
		LC50	MOR		F 0.96, 0.83 - 1.10	Vilkas, 1976
		LC50	MOR		F 0.80, 0.65 - 1.00	Ankley et al, 1991
		LC50*	MOR		F 2.0	Meier et al, 1979
		EC50	ITX/IMBL	48 h	F 1.4, 1.2 - 1.6	Sanders and Cope, 1966
<i>Simocephalus serrulatus</i>	Water flea				F 1.8, 1.4 - 2.2	Sanders and Cope, 1966
<i>Gammarus pseudolimnaeus</i>	Scud	LC50	MOR	96 h	F 2, 1 - 3	Morgan, 1976
<i>Arcatoa tonsa</i>	Copecod	N/A	N/A	N/A	N/A	Khattat and Farley, 1976
<i>Cloeon dipterum</i>	Mayfly	LC50*	MOR	48 h	F 7.8	Hashimoto and Nishiuchi, 1981
<i>Orconectes propinquus</i>	Crayfish	LC50	MOR	7 d	F 15, 4.6 - 25.4	Morgan, 1976
<i>Acroneuria ruralis</i>	Stonefly	LC50	MOR	96 h	F 16, 9 - 23	Morgan, 1976
<i>Asellus communis</i>	Aquatic sowbug	LC50	MOR	96 h	F 21, 15 - 27	Morgan, 1976
<i>Hyalella azteca</i>	Scud	LC50	MOR	48 h	F 22, 19 - 25	Morgan, 1976
<i>Chasmichthys dolichognathus</i>	Agohaze, goby	LC50	MOR	72 h	F 33	Hirose et al., 1979
				72 h	F <10 - 16	Hirose et al., 1979
				72 h	F 80	Hirose et al., 1979
				96 h	F 80, 50 - 130	Hirose et al., 1979
				96 h	F 16, 10 - 25	Hirose et al., 1979
				96 h	F <10	Hirose et al., 1979
<i>Baetis intermedius</i>	Mayfly	LC50	MOR	96 h	F 24, 6 - 42	Morgan, 1976
<i>Pteronarcys californicus</i>	Stonefly	LC50	MOR	96 h	F 25.0	Cope, 1966
<i>Seriola quinqueradiata</i>	Yellowtail	LC50*	MOR	48 h	F 40	Hirose and Kitsukawa, 1976
<i>Paraleptophlebia pallipes</i>	Mayfly	LC50	MOR	96 h	F 44, 15 - 73	Morgan, 1976
<i>Physa gyrina</i>	Pouch snail	LC50	MOR	96 h	F 48, 36 - 60	Morgan, 1976
<i>Lestes congener</i>	Damselfly	LC50	MOR	96 h	F 50	Federle and Collins, 1976
<i>Anguilla anguilla</i>	Common eel	LC50	MOR	96 h	F 80, 60 - 100	Ferrando et al, 1991

Scientific name	Common name	Endpoint ^a	Effect/Effect Measured ^b	Duration	Concentration ($\mu\text{g/L}$) ^c	Reference
Girella punctata	Green fish	LC50	MOR	72 h	F 56	Hirose et al., 1979
				72 h	F 220	Hirose et al., 1979
				96 h	F 56	Hirose et al., 1979
				96 h	F 160, 130 - 190	Hirose et al., 1979
Orthetrum albistylum speciosum	Dragonfly	LC50*	MOR	48 h	F 140	Hashimoto and Nishiuchi, 1981
Leuciscus idus	Ide, silver or golden orfe	LC50	MOR	96 h	F 150	Bathe et al, 1975
Gammarus lacustris	Scud	LC50	MOR	96 h	F 200, 150 - 280	Sanders, 1969
					F 170, 118 - 222	Morgan, 1976
Lepomis macrochirus	Bluegill	LC50	MOR	96 h	A 480, 340 - 670	Allison and Hermanutz, 1977
		LC50			A 440, 310 - 620	Allison and Hermanutz, 1977
		LC50			F 170	Dennis et al, 1979
		LC50			F 530	Dennis et al, 1979
		LC50			F 120	Meier et al., 1979
		LC50			A 168, 120 - 220	Johnson and Finley, 1980
		LC50			F 170	Dennis et al, 1979
		LC50			F 530	Dennis et al, 1979
		LC50			F 22	Cope, 1965
		LC50*			T 400 - 800	Posner and Reimer, 1970
Mugil curema	White mullet	LC50	MOR	24 h and 48 h	F 250	Butler, 1963
Notemigonus crysoleucas	Golden shiner	LC50*	MOR	96 h	T 400 - 800	Posner and Reimer, 1970
Misgurnus anguillicaudatus	Oriental weatherfish	LC50*	MOR	48 h	F 500	Hashimoto and Nishiuchi, 1981
Helisoma trivolvis	Ramshorn snail	LC50	MOR	7 d	F 528, 349 - 707	Morgan, 1976
Salvelinus namaycush	Lake trout, siscowet	LC50	MOR	96 h	A 602, 400 - 906	Johnson and Finley, 1980
Salvelinus fontinalis	Brook trout	LC50	MOR	96 h	A 800, 440 - 1140	Allison and Hermanutz, 1977
		LC50			A 450, 320 - 630	Allison and Hermanutz, 1977
		LC50			A 1050, 720 - 1520	Allison and Hermanutz, 1977
		LC50*			T 400 - 800	Posner and Reimer, 1970
Oncorhynchus mykiss	Rainbow trout, donaldson trout	LC50	MOR	96 h	F 1350	Meier et al, 1979
					F 90	Cope, 1965
					A 400, 230 - 700	Beliles, 1965
					F 3200, 2400 - 4200	Bathe et al, 1975
					F 455	Anees, 1975
Channa punctata	Snake-head catfish	LC50	MOR	96 h	F 3100	Sastray and Sharma, 1980
					F 1273, 977 - 1820	Li and Chen, 1981
Gambusia affinis	Western mosquitofish	LC50	MOR	48 h	F 1300	Tanaka et al, 1984

Scientific name	Common name	Endpoint ^a	Effect/Effect Measured ^b	Duration	Concentration ($\mu\text{g/L}$) ^c	Reference
<i>Cyprinodon variegatus</i>	Sheepshead minnow	LC50	MOR	96 h	A 1470, 1070 - 3310	Goodman et al, 1979
<i>Poecilia sphenops</i>	Molly	LC50	MOR	7 d	F 1600	Chatterjee, 1975
<i>Jordanella floridae</i>	Flagfish	LC50	MOR	96 h	A 1500, 1200 - 1900	Allison and Hermanutz, 1977
					A 1800, 1600 - 2000	Allison and Hermanutz, 1977
<i>Hirudo nipponia</i>	Asian leech	EC50*	ITX/IMBL	48 h	F 1500	Kimura and Keegan, 1966
					F 2400	Kimura and Keegan, 1966
<i>Poecilia reticulata</i>	Guppy	LC50	MOR	96 h	F 3000	Bathe et al, 1975
					F 3400	Maas, 1982
					F 800	Keizer et al, 1990
<i>Heteropneustes fossilis</i>	Indian catfish	LC50	MOR	96 h	F 2270	Verma et al, 1982
<i>Cyprinus carpio</i>	Common, mirror, colored, carp	LC50	MOR	72 h	F 3110	Toor and Kaur, 1974
		LC50*			F 2000	Nishiuchi and Asano, 1981
<i>Cyclops</i>	Cyclopoid copepod	LC50	MOR	7 d	F 2510	Chatterjee, 1975
<i>Oncorhynchus clarkii</i>	Cutthroat trout	LC50	MOR	96 h	A 1700, 1390 - 2090	Johnson and Finley, 1980
		LC50*			F 3850, 2920 - 5070	Swedburg, 1973
		LC50*			F 2760, 2280 - 3330	Swedburg, 1973
<i>Tubifex</i>	Tubificid worm	LC50	MOR	7 d	F 3160	Chatterjee, 1975
<i>Danio rerio</i>	Zebra danio	LC50	MOR	96 h	F 2120, 2080 - 2160	Ansari et al, 1987
					F 8000	Keize et al, 1990
<i>Physella acuta</i>	European physa, bladder snail	LC50	MOR	48 h	F 4800	Nishiuchi and Yoshida, 1972
<i>Selenastrum capricornutum</i>	Algae	N/A	N/A	N/A	N/A	Hughes, 1988

Scientific name	Common name	Endpoint ^a	Effect/Effect Measured ^b	Duration	Concentration ($\mu\text{g/L}$) ^c	Reference
Pimephales promelas	Fathead minnow	LC50	MOR	96 h	A 6800, 5400 – 8500	Allison and Hermanutz, 1977
					A 6600, 5100 – 8600	Allison and Hermanutz, 1977
					A 10000, 6700 – 15000	Allison and Hermanutz, 1977
					F 5600 – 10000	Dennis et al, 1979
					F 3700	Dennis et al, 1979
					F 10300	Meier et al, 1979
					F 5600 – 10000	Dennis et al, 1979
					F 3700	Dennis et al, 1979
					A 4300, 3400 – 5200	Jarvinen and Tanner, 1982
					A 6100, 5000 – 7600	Jarvinen and Tanner, 1982
Oryzias latipes	Medaka, high-eyes	LC50*	MOR	72 h	F <20000	Asaka et al, 1980
					F 9100	Asaka et al, 1980
					F <2100	Asaka et al, 1980
Ameiurus melas	Black bullhead	LC50	MOR	96 h	F 8000	Bathe et al, 1975
Carassius auratus	Goldfish	LC50	MOR	96 h	A 9000, 7300 – 11200	Beliles, 1965
Semisulcospira libertina	Marsh snail	LC50	MOR	48 h	F 9500	Nishiuchi and Yoshida, 1972
Carassius carassius	Crucian carp	LC50	MOR	96 h	F 5000	Bathe et al, 1975
					F 23400, 18700 – 29100	Bathe et al, 1975
Bufo bufo japonicus	Toad	LC50*	MOR	48 h	F 14000	Hashimoto and Nishiuchi, 1981
Indoplanorbis exustus	Snail	LC50*	MOR	48 h	F 20000	Hashimoto and Nishiuchi, 1981
Brachionus calyciflorus	Rotifer	LC50	MOR	2 d	F 31000	Snell and Moffat, 1992
				24 h	F 29220, 28470 – 29960	Fernandez-Casalderrey et al, 1992
				24 h	F 29220, 28470 – 29960	Fernandez-Casalderrey et al, 1992

a EC50= “Median Effective Concentration: Effective concentration for 50% of the organisms tested. Used when an effect other than death is the observed endpoint.”

LC50= “Median Lethal Concentration: Statistically estimated concentration that is expected to be lethal to 50% of a group of organisms tested. Death may be defined by the mortality, intoxicification and population effect groups. TLms and TL50s with death as the measured endpoint are reported as LC50*.” (USEPA, 2003).

^b MOR= Mortality as measured by Mortality; MOR/SURV= Mortality as measured by Survival; MOR/HTCH= Mortality as measured by Hatchability; ITX/IMBL= Intoxication as measured by Immobility

^c A= Active Ingredient Concentration; F= Formulation Concentration; T= Total Concentration.
Note – USEPA codes pesticide concentration effects data with an “F”, if the study did not specify whether reported concentration was based on active ingredient or formulation. The definitions provided by the USEPA for reporting of concentration type are:

F FORMULATION: Generally reserved for commercial preparation prior to actual use and does not include the final dilution (e.g.; Baythroid, 2,4-D). Also included in this category are organic compounds with no pesticidal activity (e.g.; PCB, dioxin).

A ACTIVE INGREDIENT: Author refers to the concentration as active ingredient, active principle or various grades of reagents.

T TOTAL: The concentration of metals determined on an unfiltered sample after vigorous digestion, or the sum of the concentrations of metals in both dissolved and suspended fractions. Heavy metals and single elements (e.g. Na, Cl, Br) are coded as T.